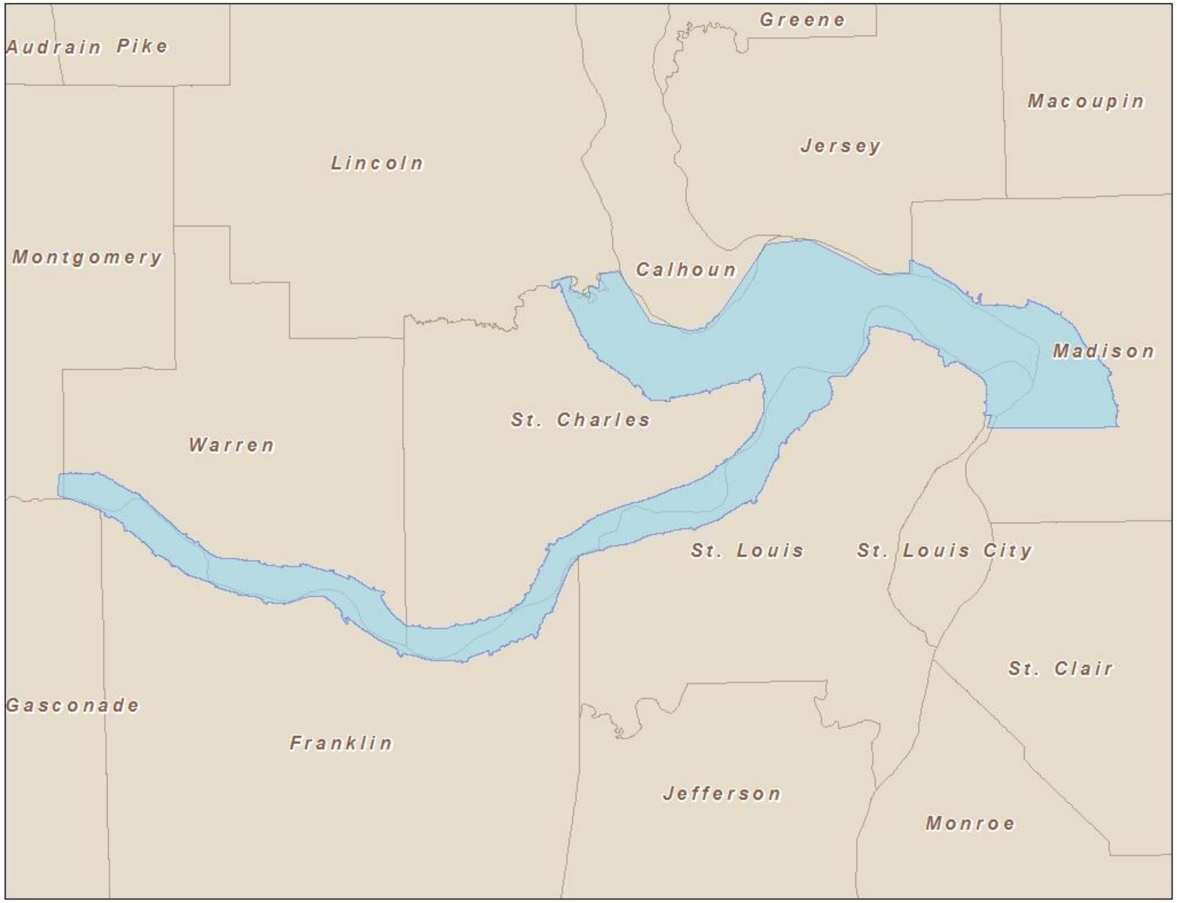
East-West Gateway Missouri River Wetlands Study Area



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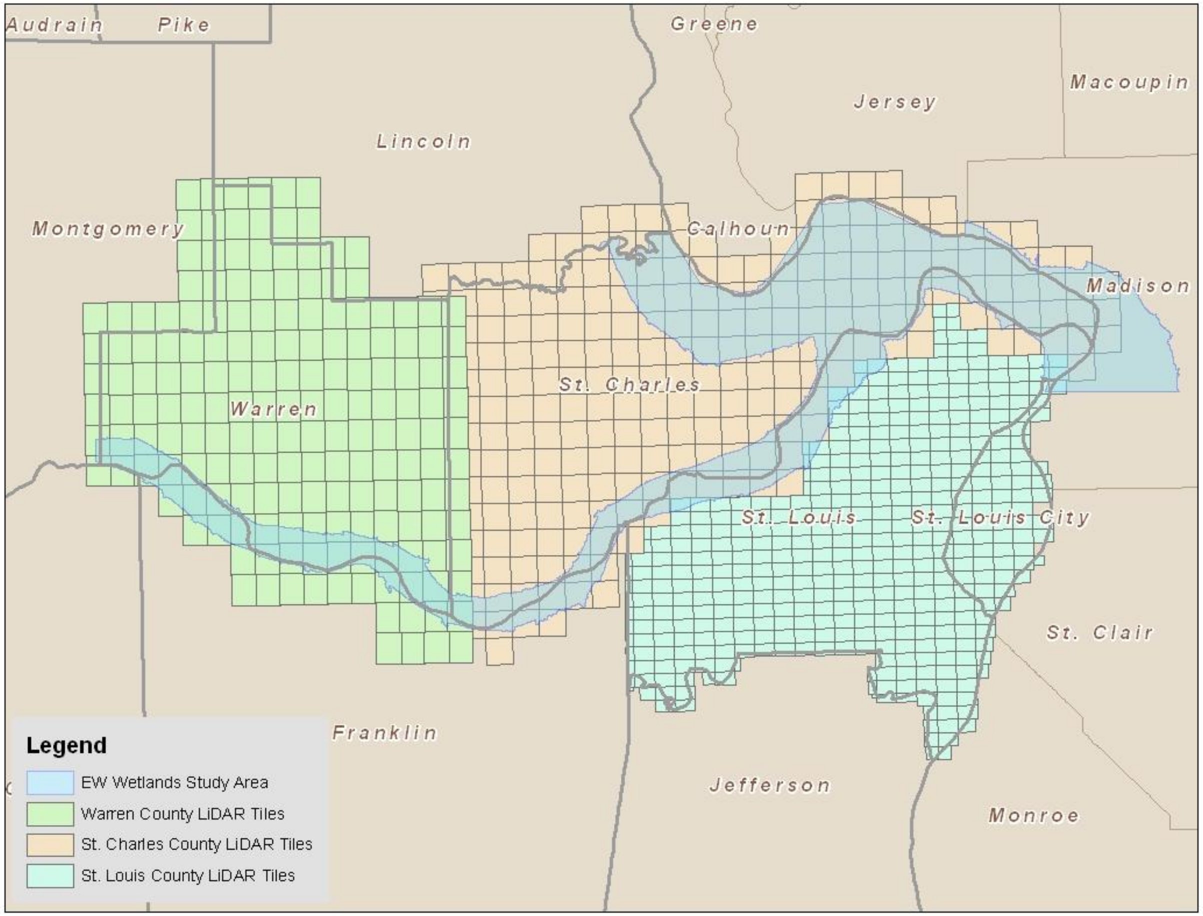
Goal: Existing and Potential Wetland Mapping

- Improve upon previous wetland delineation techniques by using LiDAR to provide
  - Finer spatial resolution DEM products
    - Digital Surface Model, vegetation height, sinks (local depressions)
  - Delineation of vegetation based on height and density
    - Herbaceous, shrub, and woodland

LiDAR Data Acquisition for East-West Gateway Wetlands Study Area

- EW Wetlands Study Area
  - Missouri River Floodplain in Warren, Franklin, St. Charles, St. Louis, St. Louis City counties in Missouri
- LiDAR Data used
  - Warren, St. Charles and St. Louis Counties
- Acquired from Washington University
  - http://maps.wustl.edu/mo_lidar_data/
- LAS files = 160 GB for all of the 3 counties and 58 GB for study area



LiDAR Software Evaluation

- Software Tested:
  - MARS Explorer
    - » Expensive, geared for a LiDAR acquisition shop, tools for QA/QC and processing of raw point files, too complicated and robust for our purposes
  - LP360 for ArcGIS
    - » Not user-friendly
  - **QT Modeler**
    - » User friendly, intuitive, great user support, good visualization tool, relatively quickly processes large point clouds into grids
    - » 64-bit version takes advantage of increased processing capabilities
      - Can process 50-100 million points for every 1 gb of RAM
        - If data has average of 1m point spacing there are 1 million vertices/sq km
  - **LAStools** - http://www.cs.unc.edu/~isenburg/lastools/
    - » Command line based tools, good for data conversion, filtering, processing and compressing, lots of user control for the advanced LiDAR analyst, not a good visualization component - free
  - ArcMap
    - » Can use tools to convert las files into points and then points into grids, lacks much user control, crude

LiDAR Pre-processing

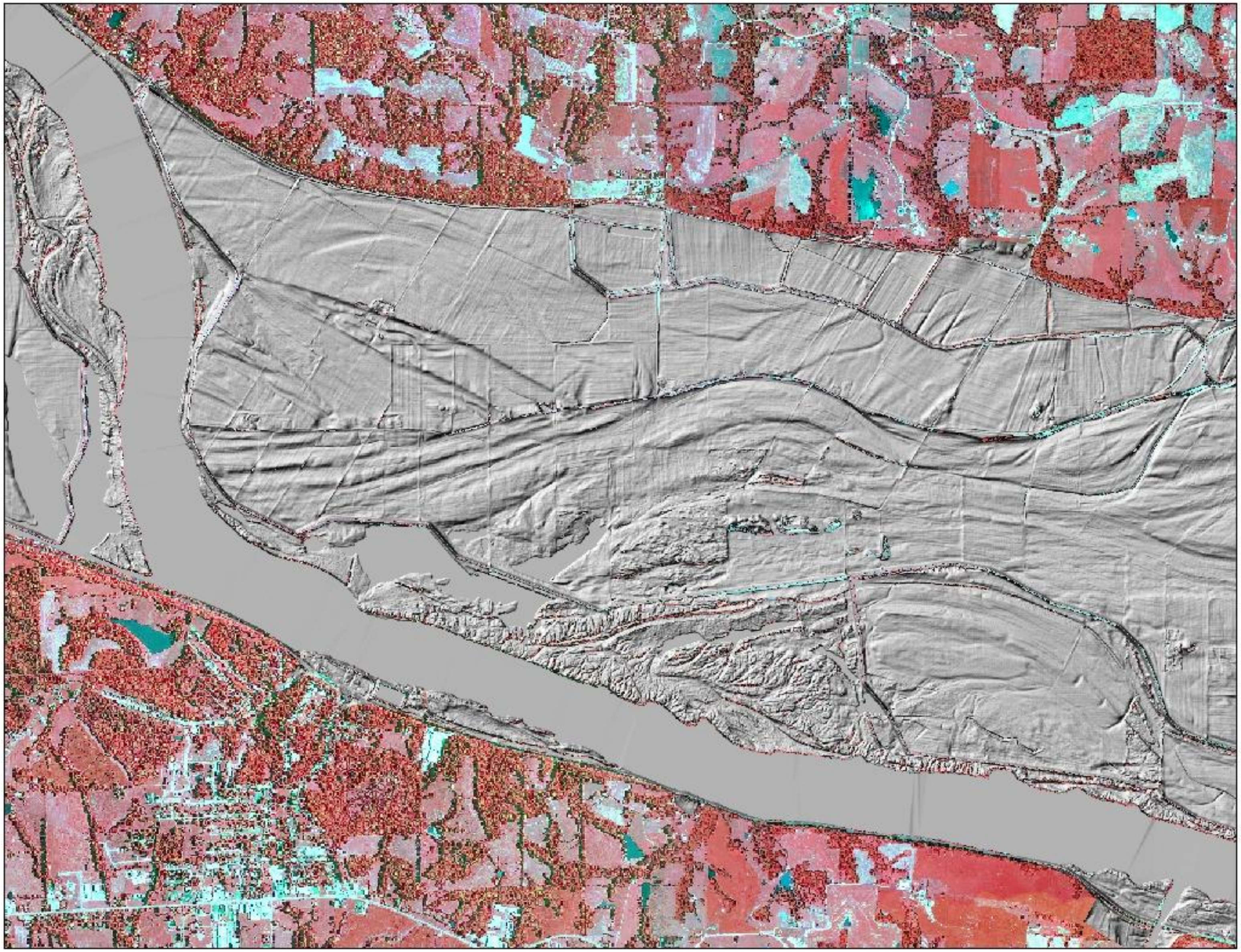
- Create a tile index for St. Louis County data using QT Modeler
  - St. Charles and Warren counties already had tile index maps
- Identify LiDAR tiles within study area
- Ensure all data is in same projection – State Plane, NAD83, GRS80, Missouri East (2403)
  - St. Charles County had metadata and header information
  - St. Louis County had no metadata or header information
    - Had to assume it was same as St. Charles County and apply projection information with QT Modeler to see if it lined up with St. Charles County
  - Warren County had no header information, but did have metadata
    - Had to view metadata to determine projection, State Plane, NAD83, GRS80, Missouri Central (2402)
    - Used LAStools to reproject and apply header information

QT Modeler LiDAR Processing

- Generation of Digital Elevation Model (DEM)
  - Load las files (text file w/ x,y,z,return,intensity)
  - Determine grid sampling size
    - A default is determined by analyzing input data
    - Larger grid size = faster processing and smaller file size
  - Gridding options
    - Hole fill/interpolation settings
      - Max distance to real point, Max Triangle Side
    - Spike/Well Removal
      - Minimum spike level and Aggressiveness
  - LAS filter selection
    - Choose points to be included in grid surface generation
      - For DEM use points classified as ground (ASPRS Class 2) or last return when working with unclassified data
  - All settings significantly affect the output

QT Modeler LiDAR Processing

- DEM

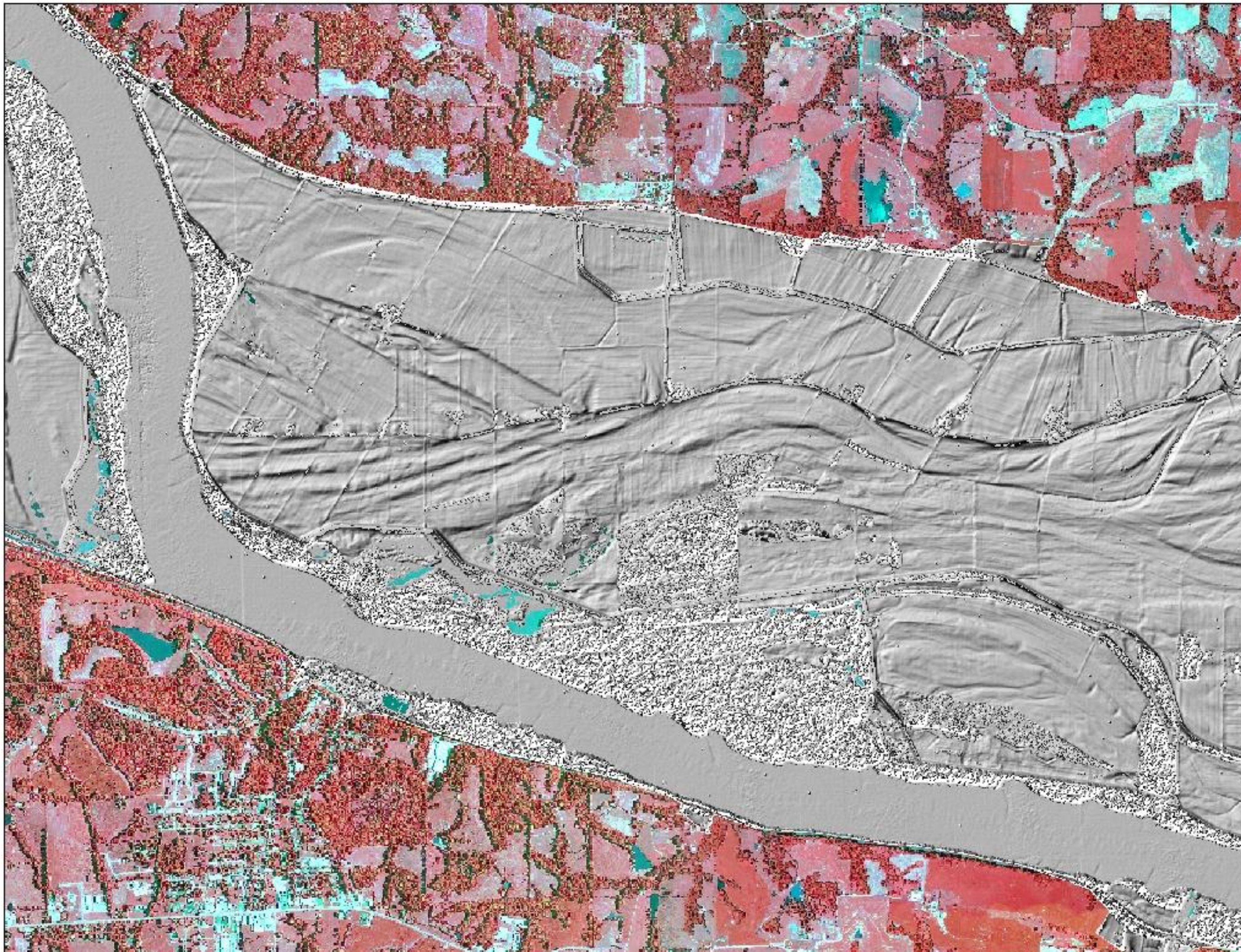


QT Modeler LiDAR Processing

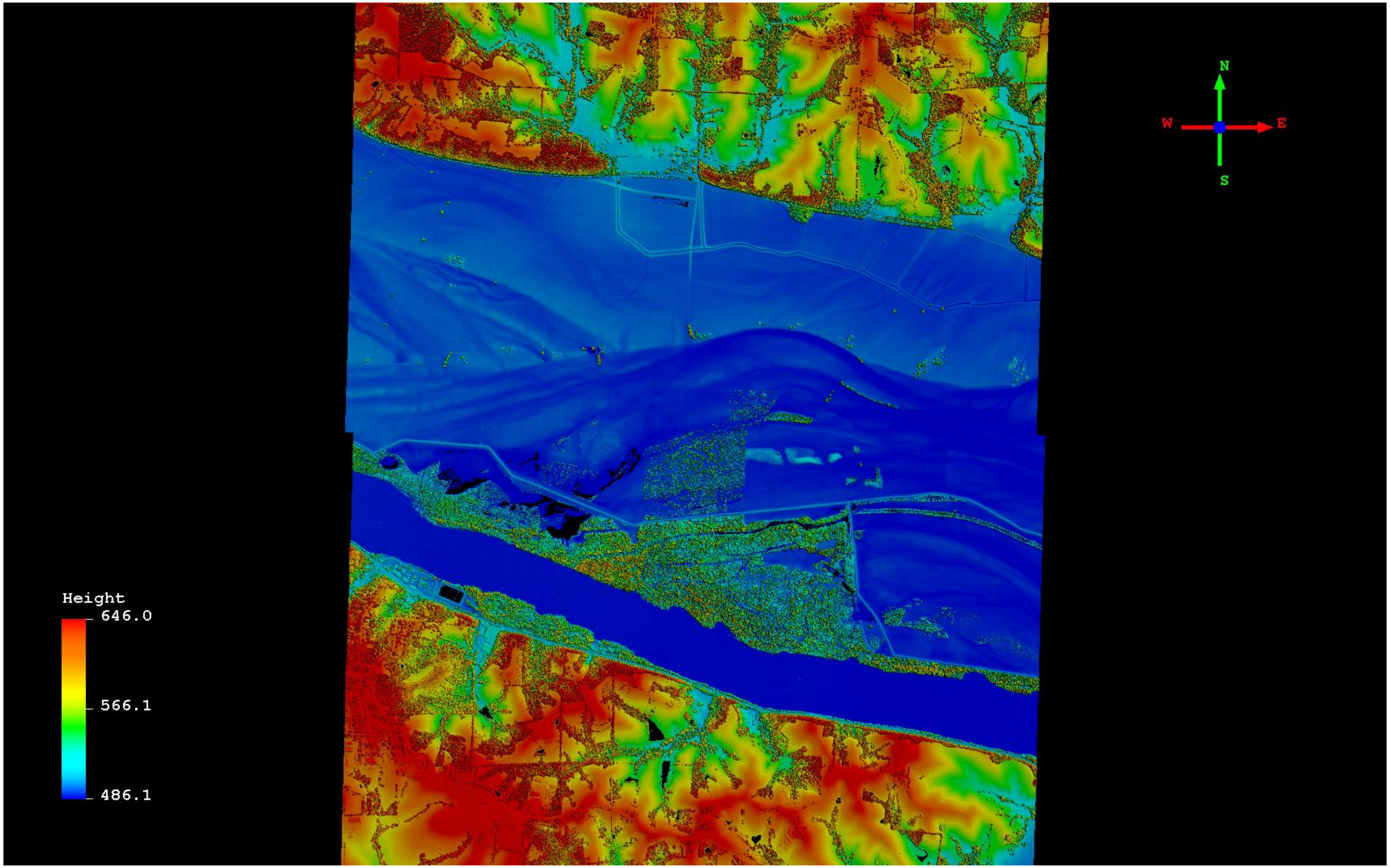
- Generation of Digital Surface Model (DSM)
  - Load las files (text file w/ x,y,z,return,intensity)
  - Determine grid sampling size
    - A default is determined by analyzing input data
    - Larger grid size = faster processing and smaller file size
  - Gridding options
    - Hole fill/interpolation settings
      - Max distance to real point, Max Triangle Side
    - Spike/Well Removal
      - Minimum spike level and Aggressiveness
  - LAS filter selection
    - Choose points to be included in grid surface generation
      - For DSM use all returns

QT Modeler LiDAR Processing

- DSM

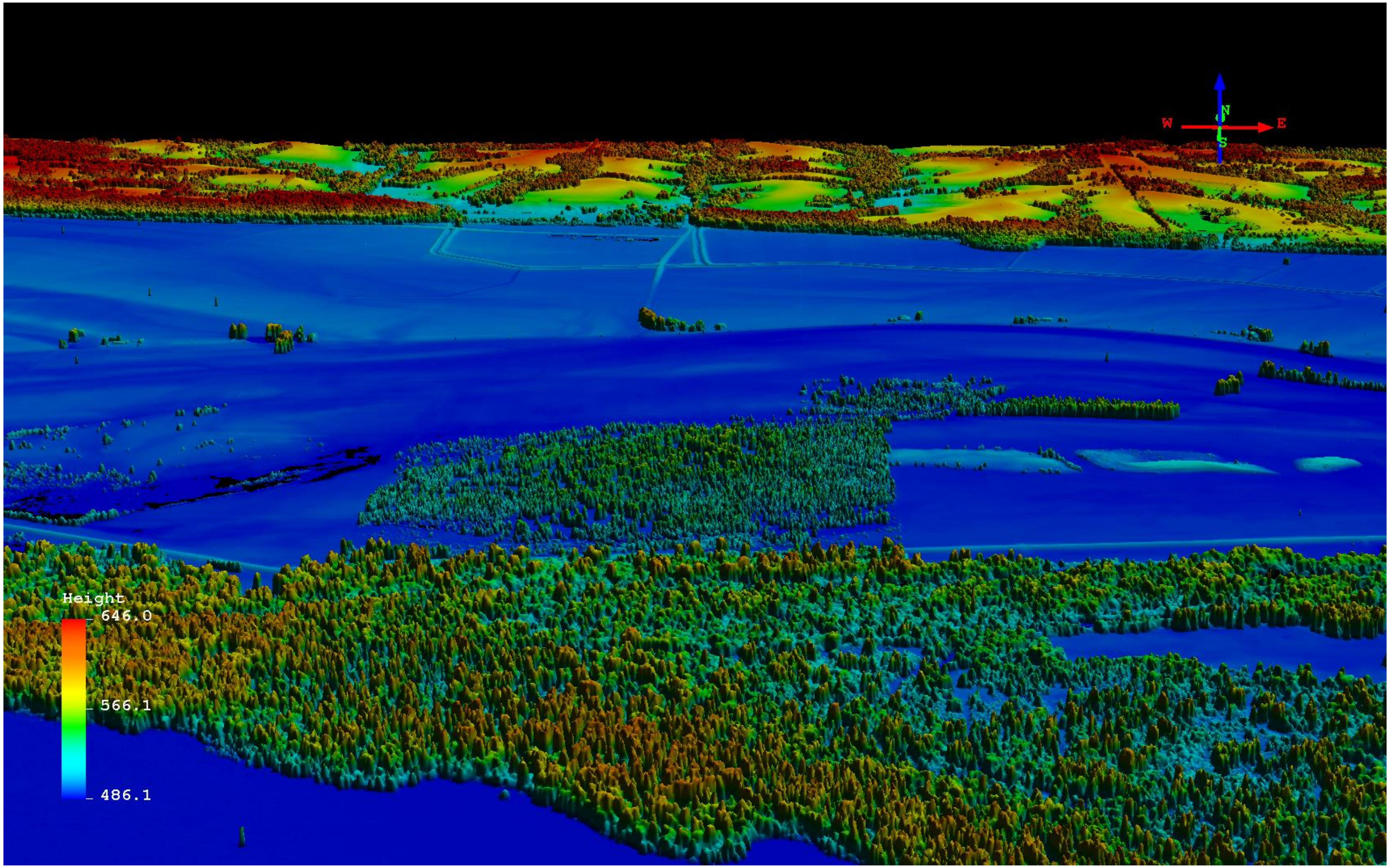


Quick Terrain Modeler Image



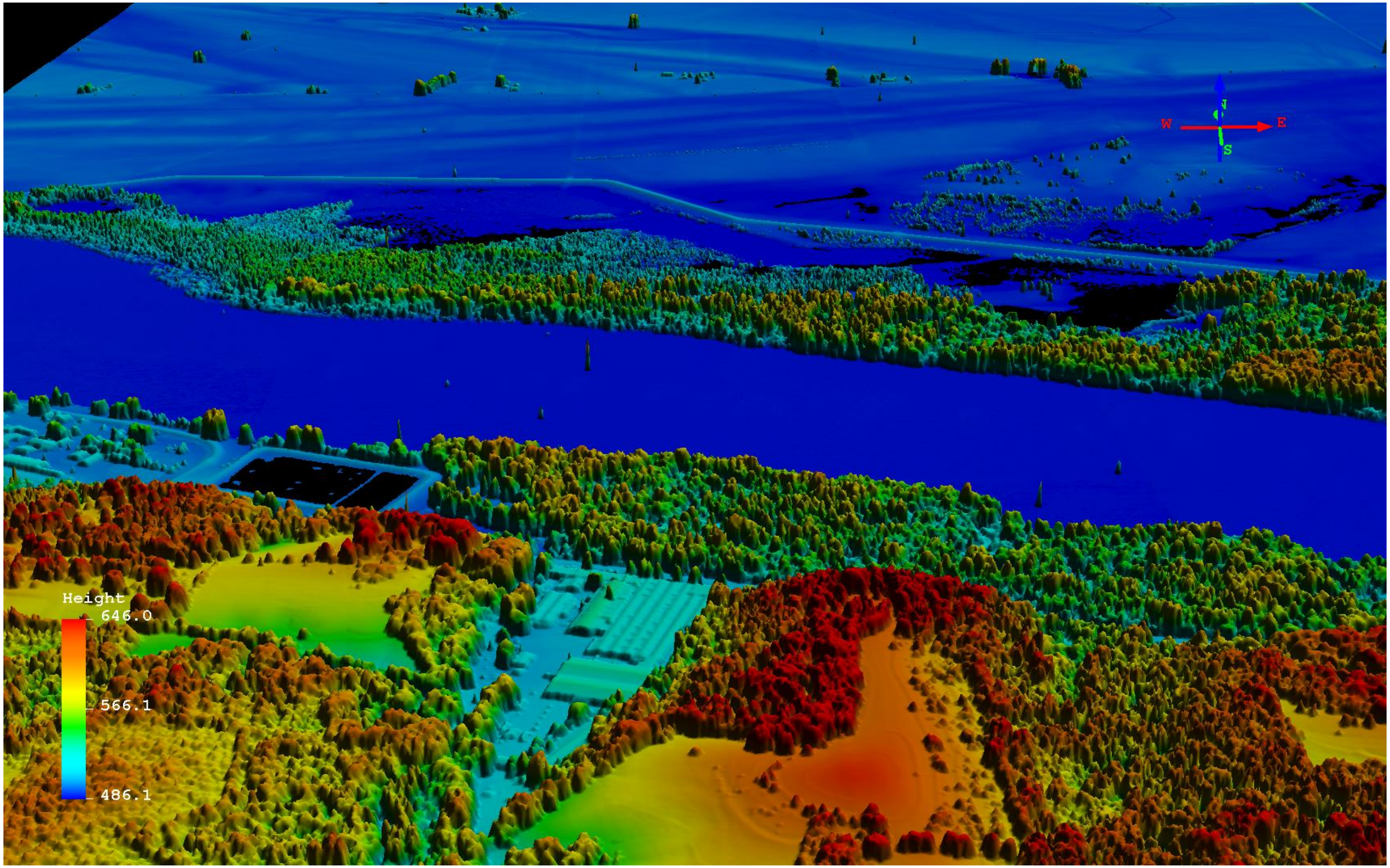
LiDAR DSM Grid

Quick Terrain Modeler Image



LiDAR DSM Grid Oblique

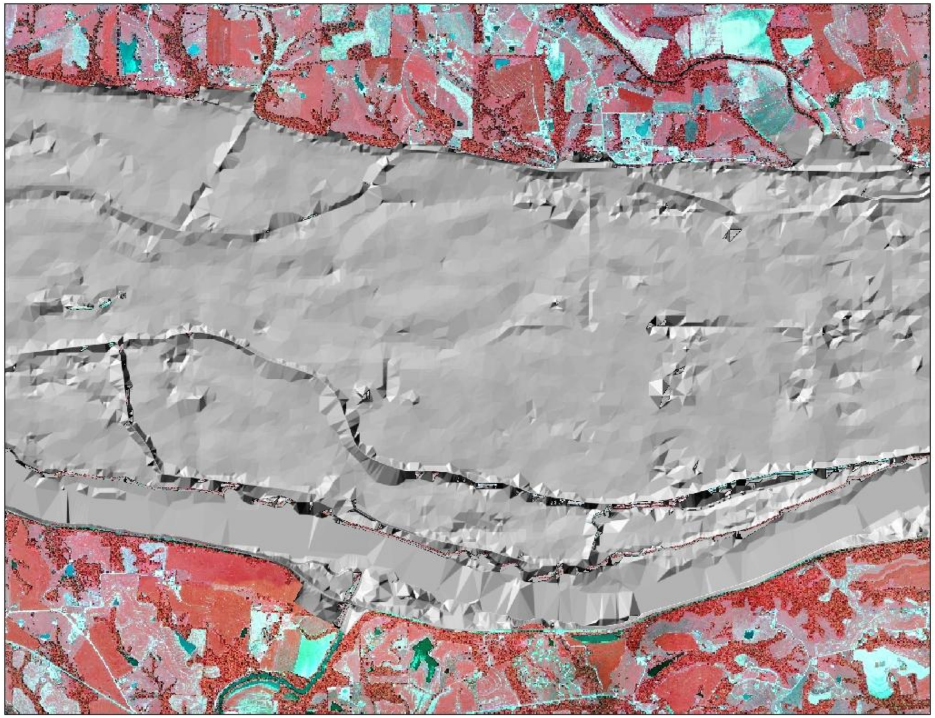
Quick Terrain Modeler Image



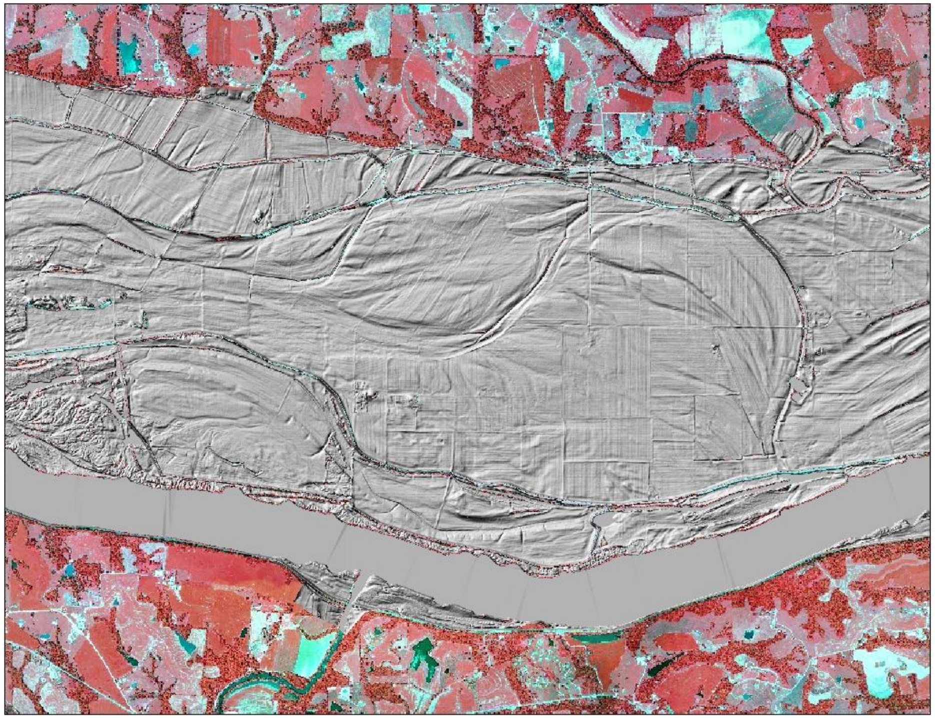
LiDAR DSM Grid Oblique

DEM Comparison

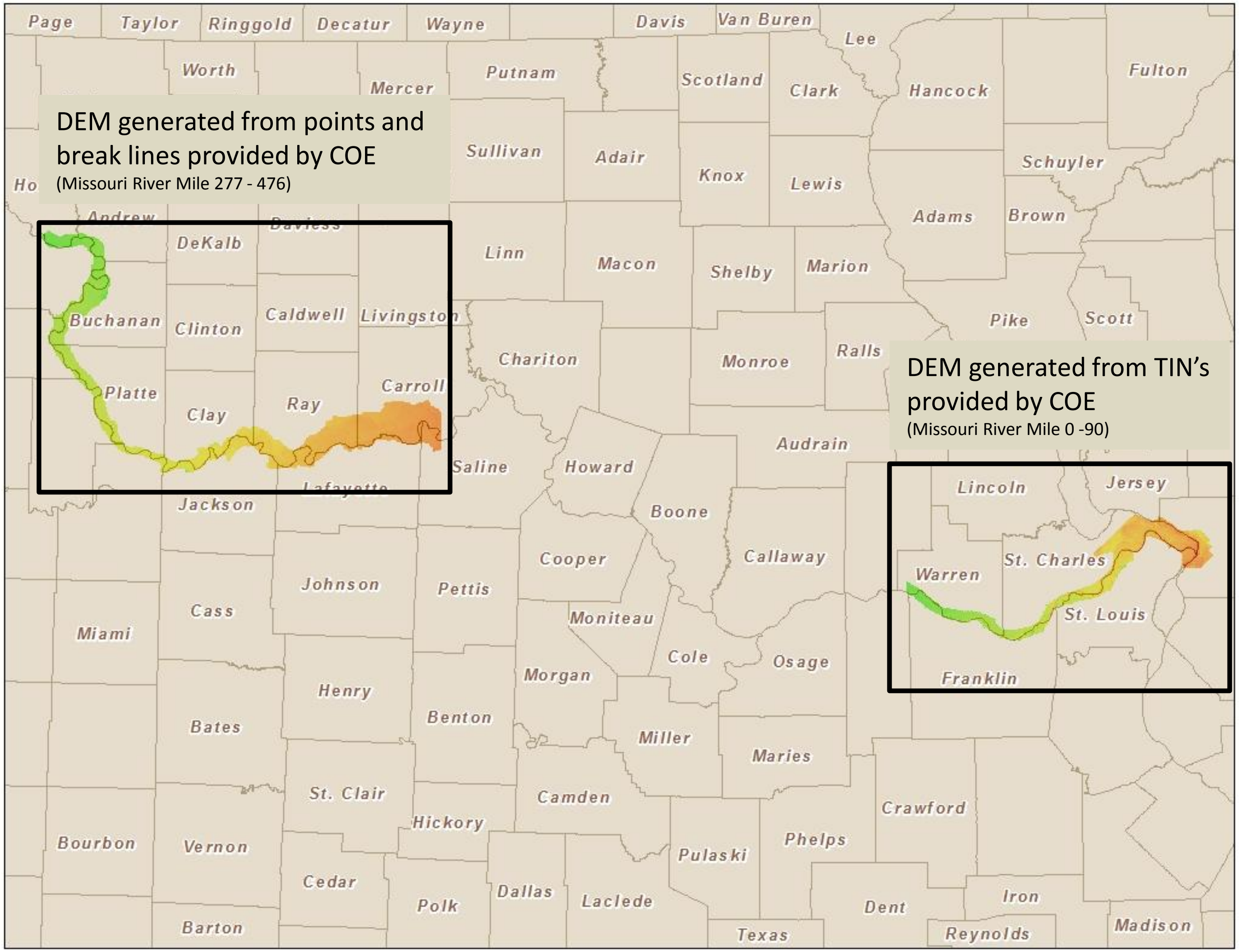
2006 COE 5 meter DEM



2008 – 2010 LiDAR 5 meter DEM



Army Corps of Engineer DEM of Missouri River Floodplain

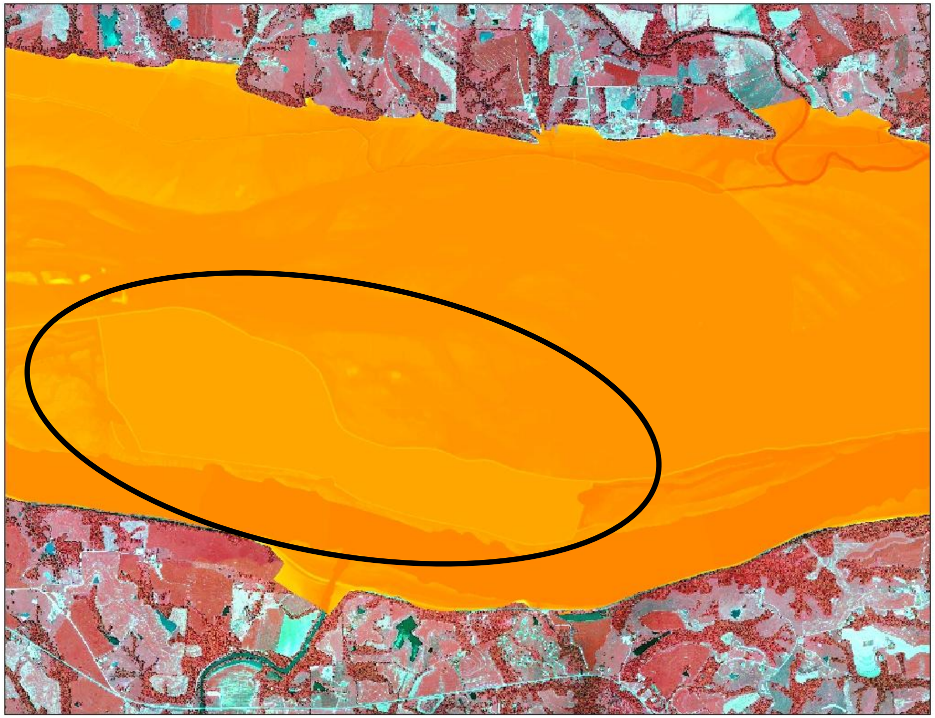


Wetland Restoration Potential

- Sinks – local depressions in landscape
- Soil drainage properties

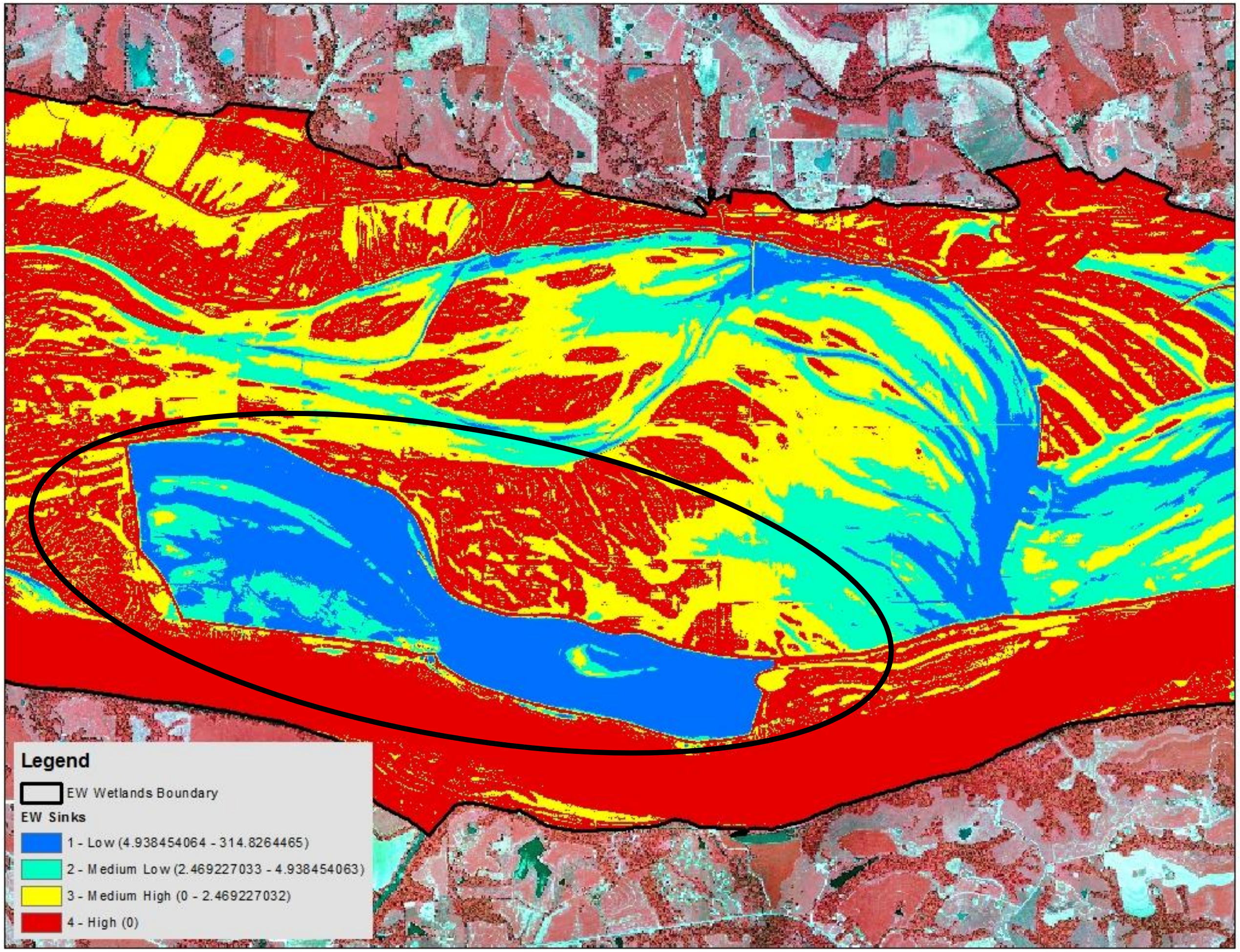
LiDAR - Sinks

2008 – 2010 LiDAR DEM Fill - 2008 - 2010 LiDAR DEM =



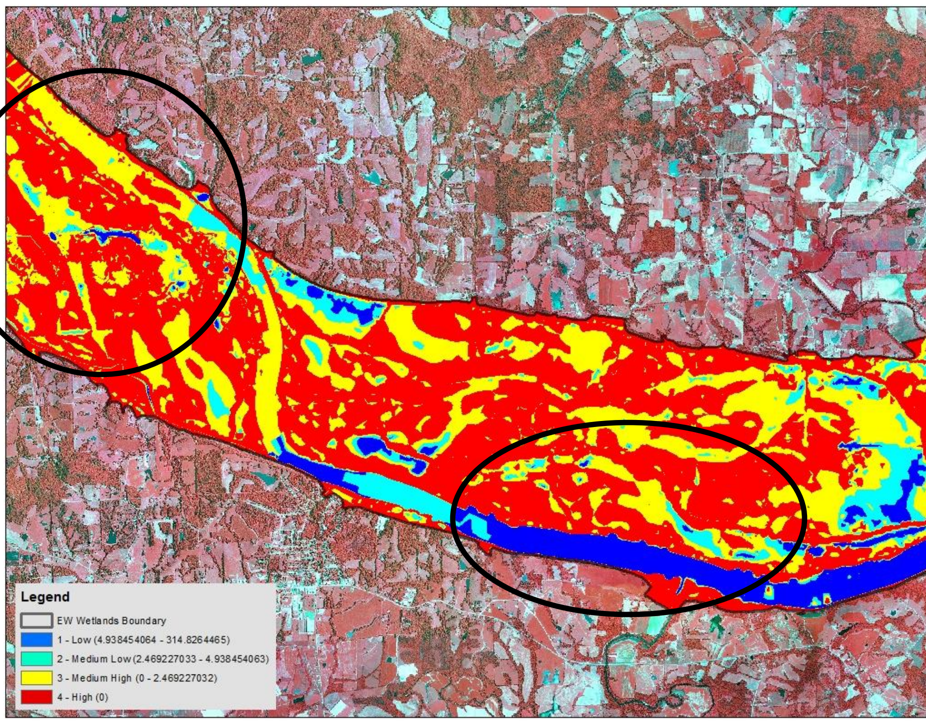
LiDAR - Sinks

Sinks (Local Depressions)

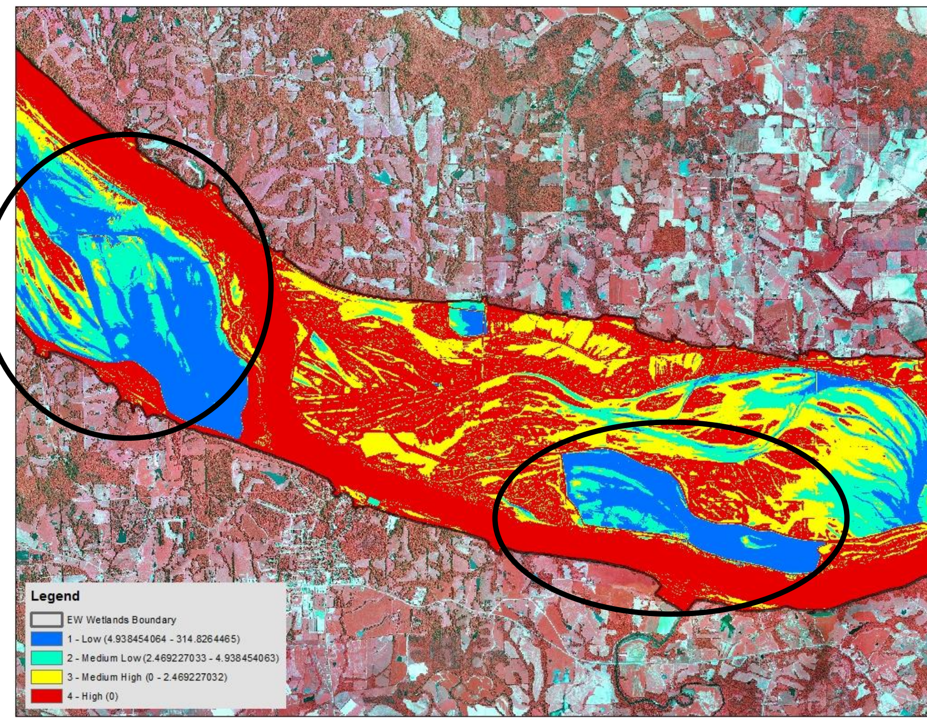


LiDAR vs. COE DEM Sinks Comparison

COE 5 m Sinks

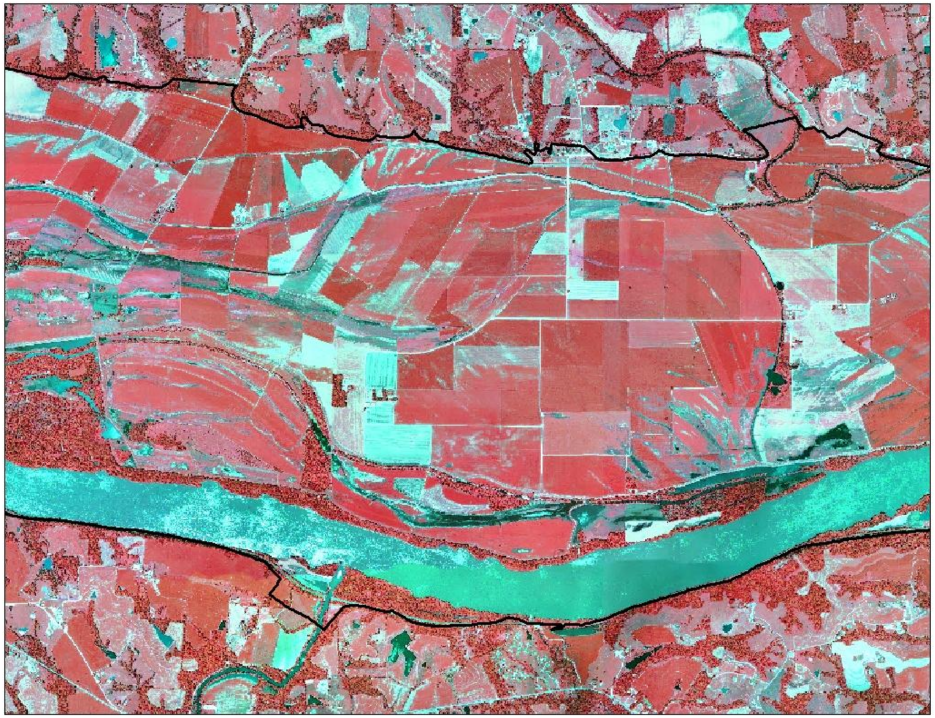


LiDAR 5 m Sinks

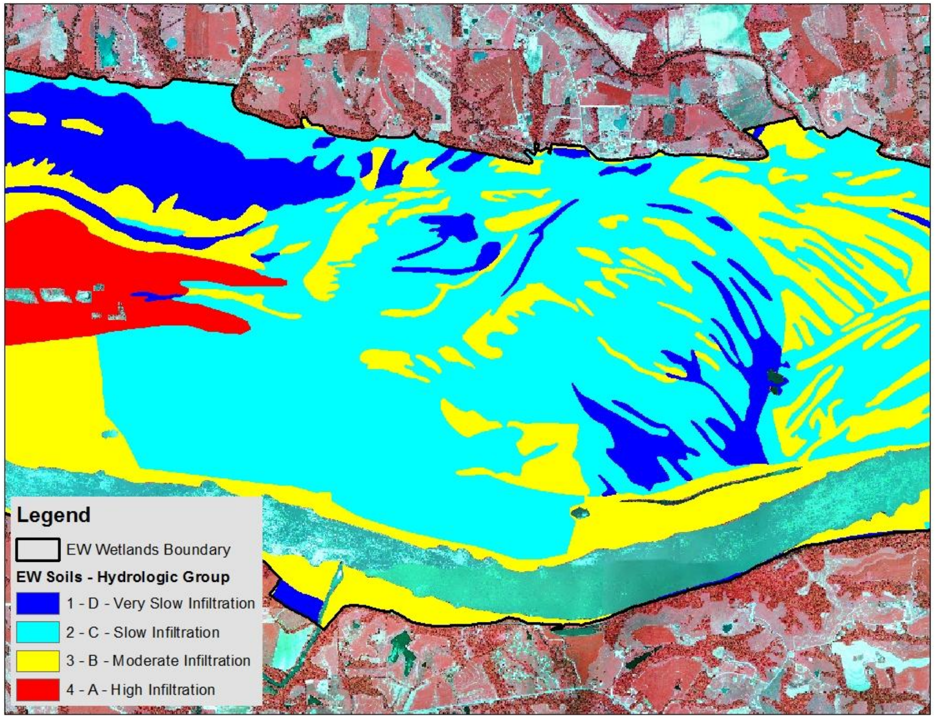


Soils

2010 NAIP



SSURGO Soils – Hydrologic Group



Soils

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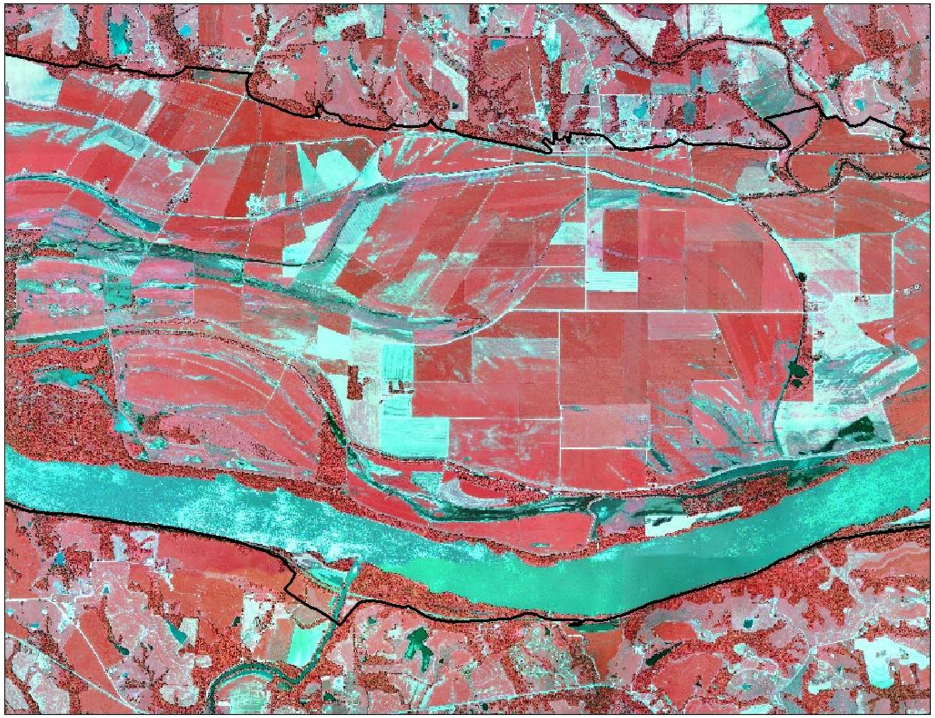
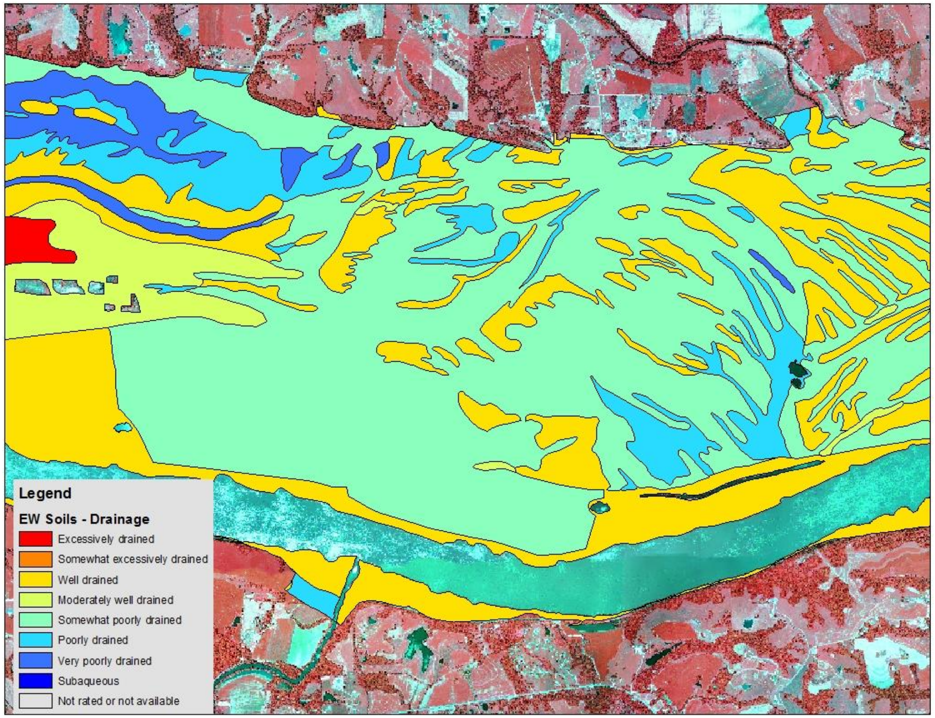


SSURGO Soils – Drainage Class

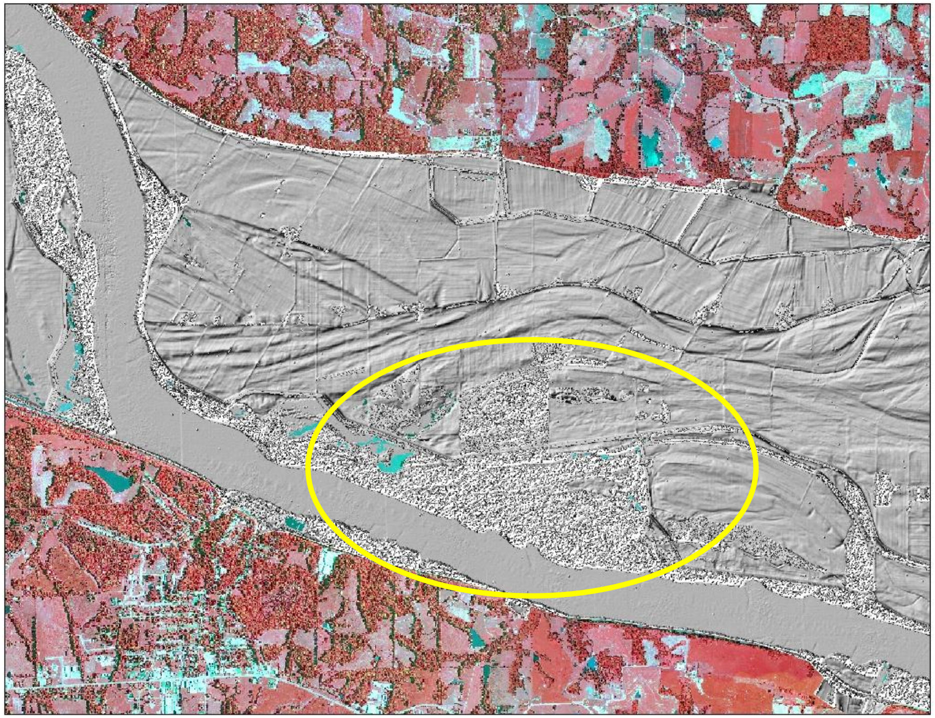


Current Wetland Vegetation Mapping Process

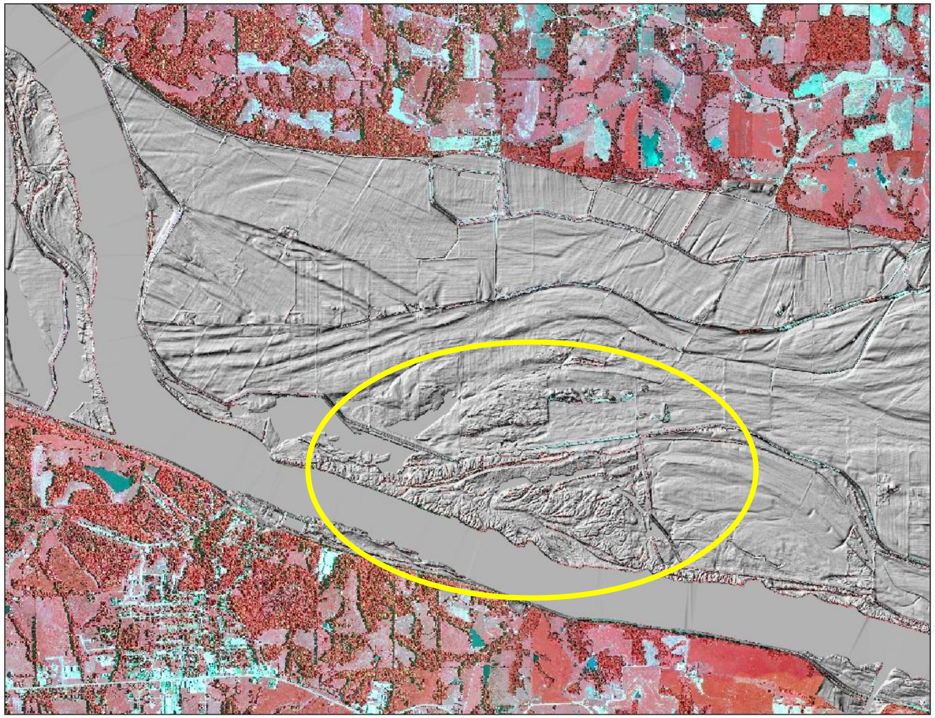
- Land Use Land Cover
- Vegetation Height
  - Herbaceous, shrub, woodland
- Objects delineation of homogeneous features on landscape

LiDAR – Vegetation Height

2008 – 2010 LiDAR 5 meter DSM -

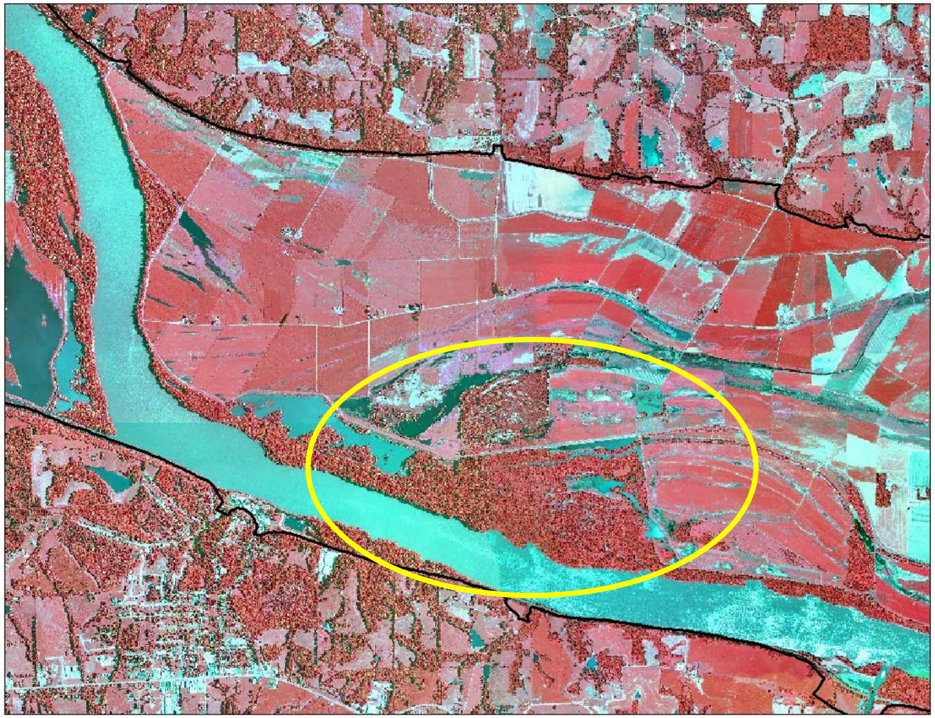


2008 – 2010 LiDAR 5 meter DEM =

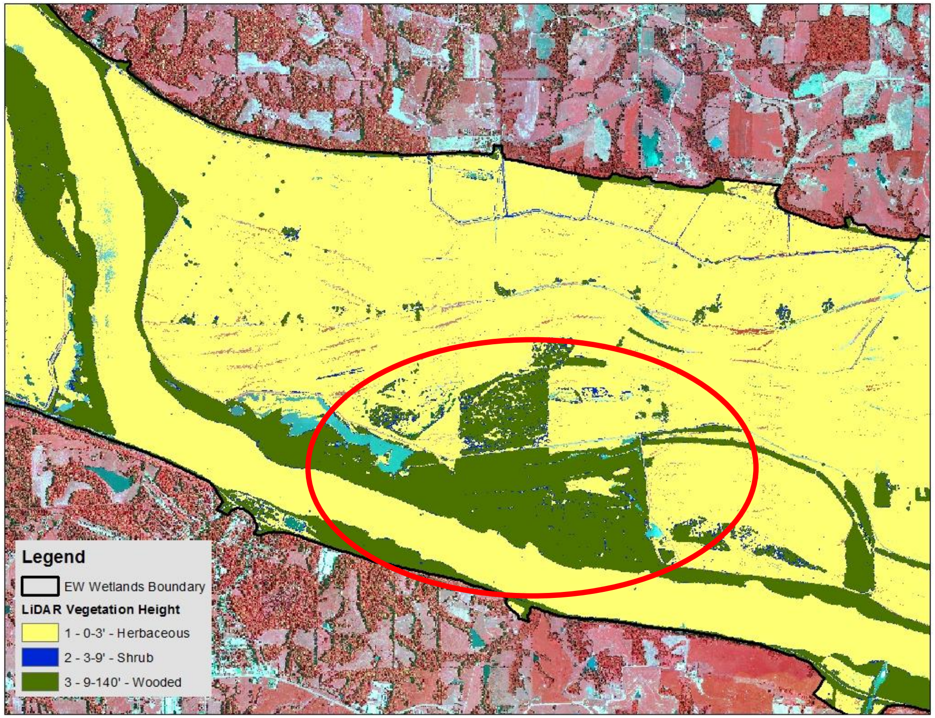


LiDAR – Vegetation Height

2010 NAIP

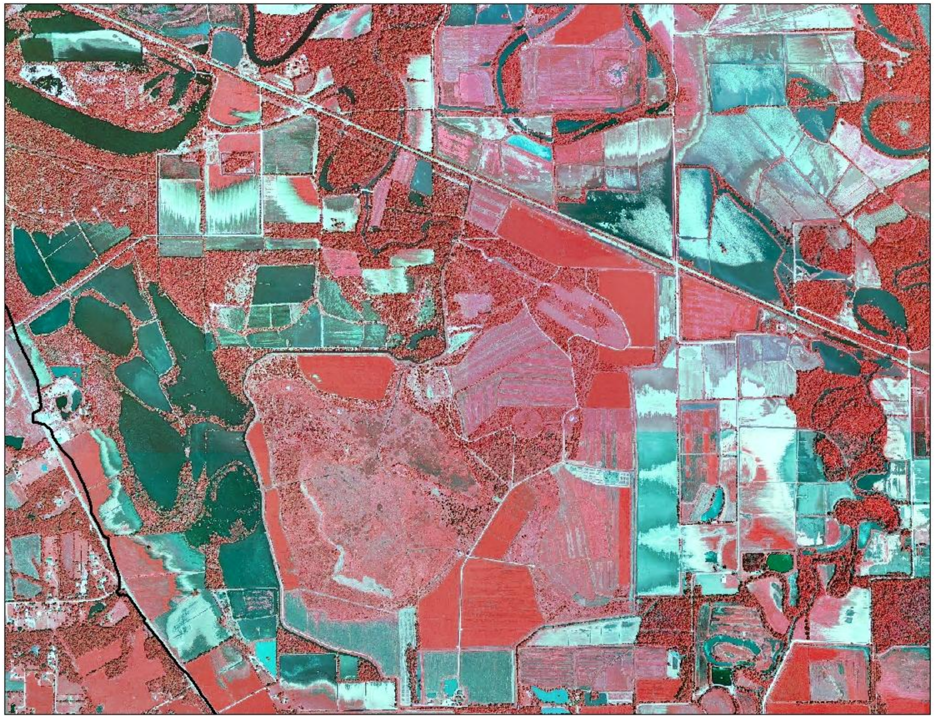


2008 – 2010 LiDAR Vegetation Height

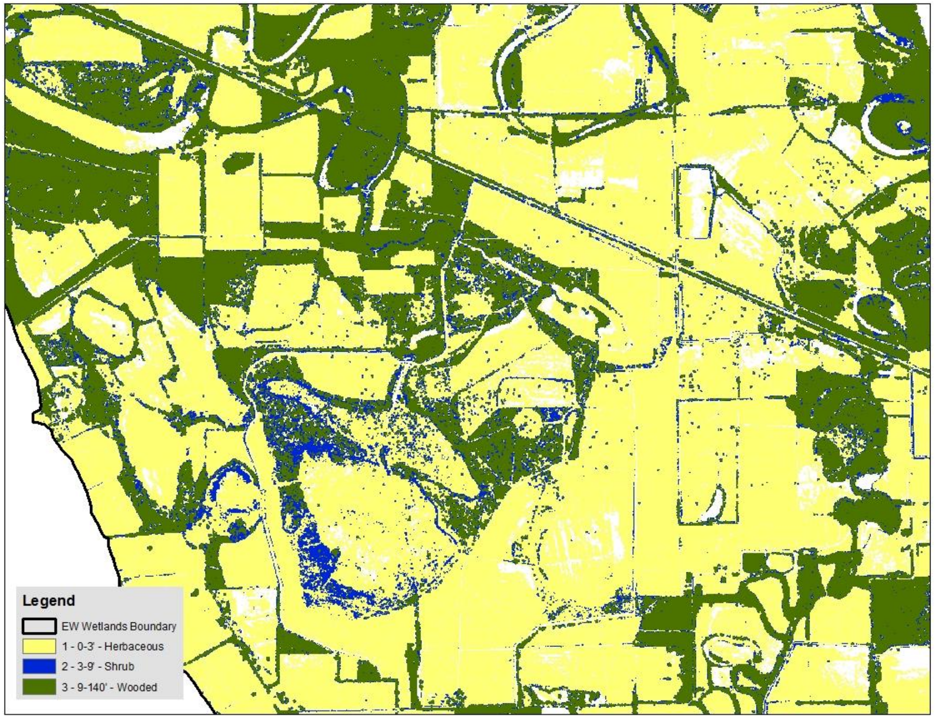


LiDAR – Vegetation Height

2010 NAIP



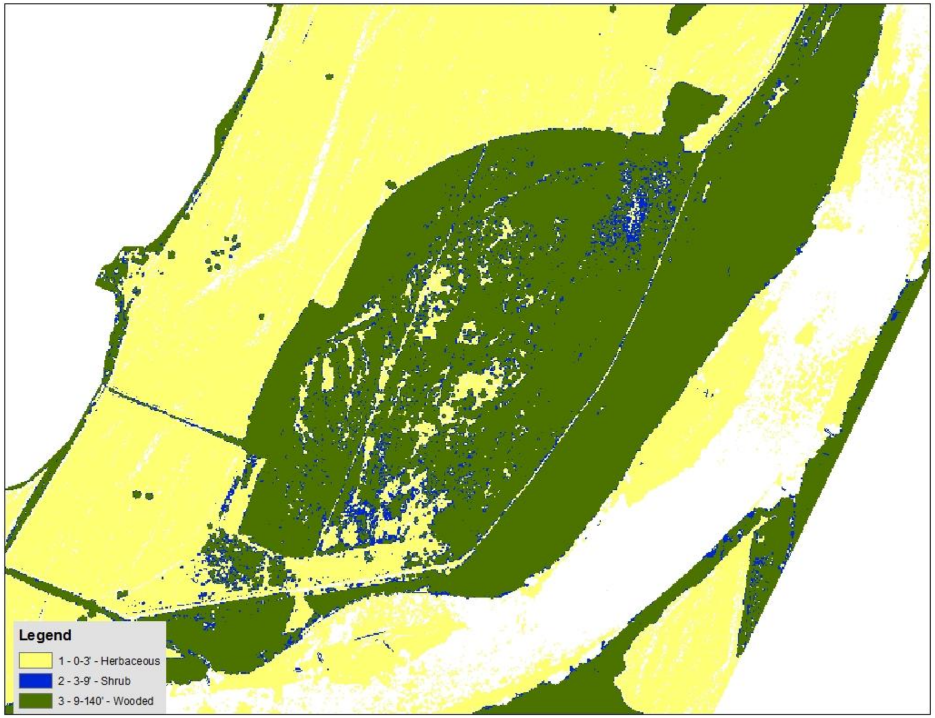
2008 – 2010 LiDAR Vegetation Height



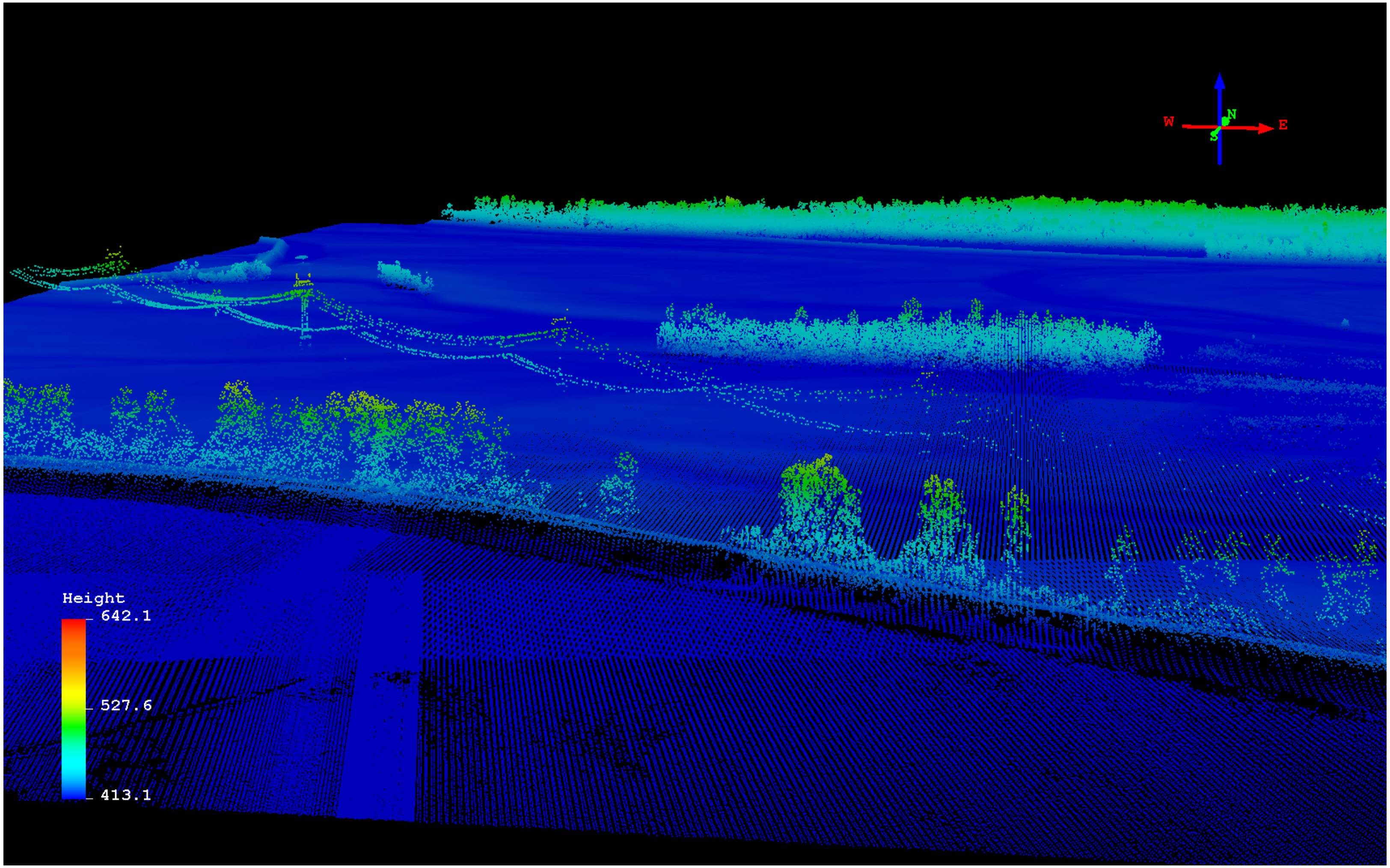
LiDAR – Vegetation Height

2010 NAIP

2008 – 2010 LiDAR Vegetation Height



- Issues w/ data
  - Unable to filter all spikes and features such as power lines



- Issues w/ data
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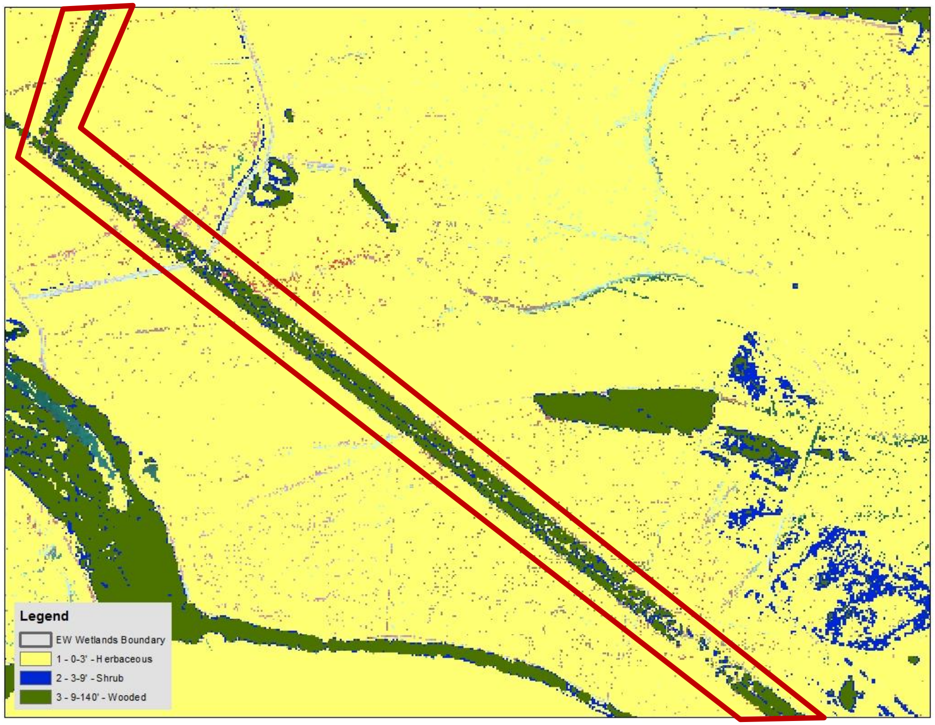
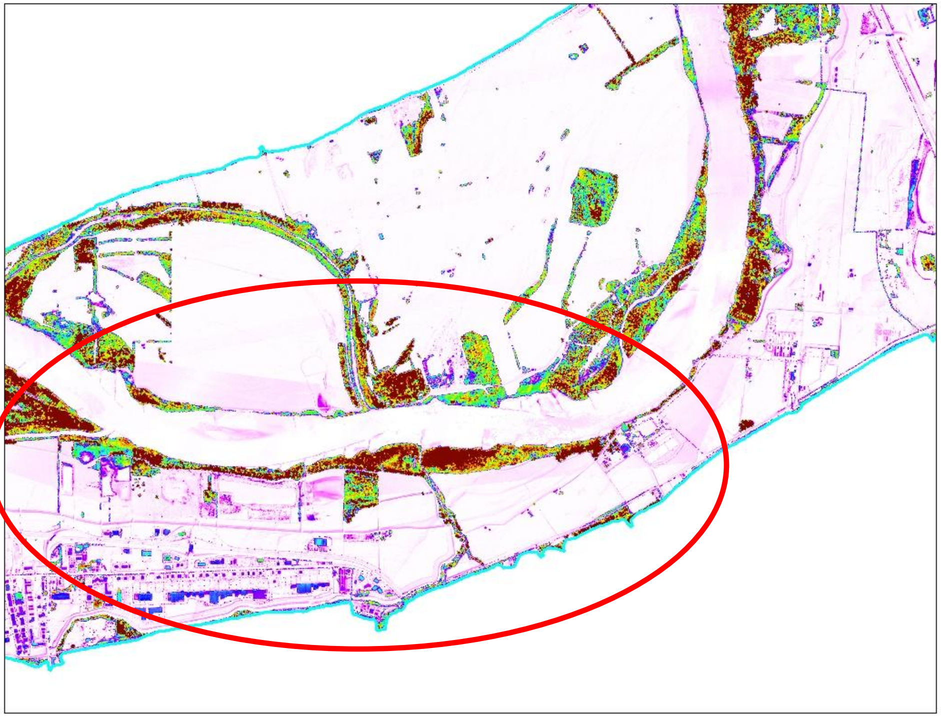
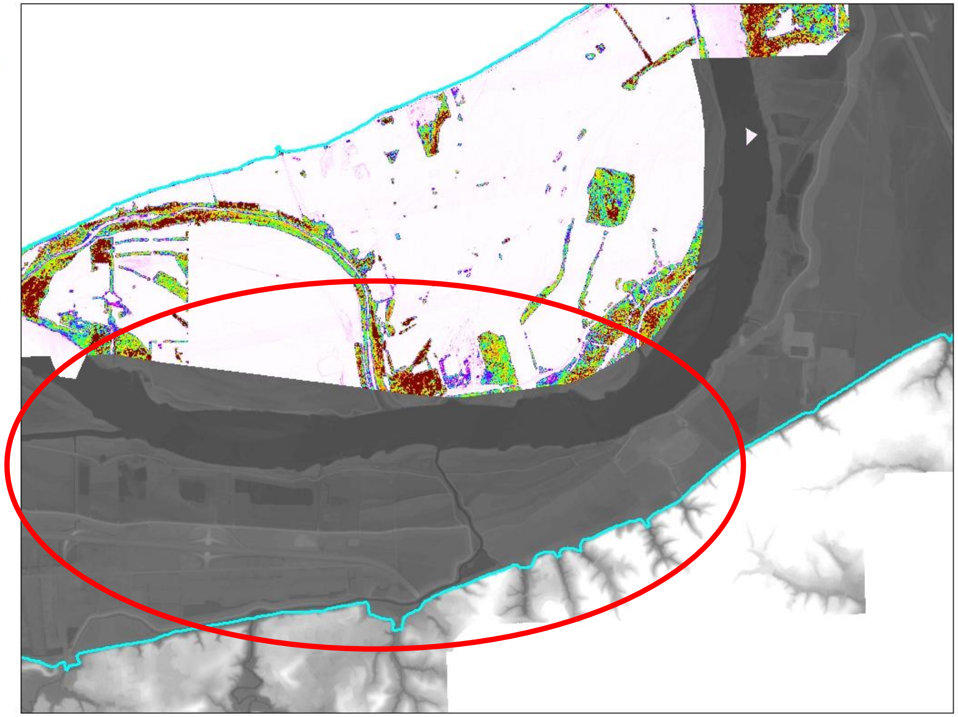
Leaf-off NAIP

LiDAR Vegetation Height



- Issues w/ data
  - Seam line where St. Louis County data meets St. Charles and Warren County





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